

Concept for the preservation of the Lepidoptera biodiversity in agrolandscapes

A. N. Poltavsky

Samenvatting. Concept voor het behoud van de biodiversiteit aan Lepidoptera in agrarische landschappen.

In de streek rond Rostov-on-Don is het grootste deel van het land ingenomen voor agrarische activiteiten, waarbij grote hoeveelheden insecticiden worden gebruikt. De daartussen liggende refugia worden dus eveneens ernstig bedreigd. Om de soortenrijkdom aan Lepidoptera en andere insecten te behouden dringen zich ernstige maatregelen op, zoals het gebruik van minder persistente insecticiden en het verbieden van het sproeien met vliegtuigen.

Résumé. Projet pour la préservation de la biodiversité de lépidoptères dans des régions agricoles.

Dans la région de Rostov-on-Don la pluspart du pays est occupée par des activités agricoles, où on utilise de grandes quantités d'insecticides. Les refuges avoisinants sont également menacés. Pour préserver la biodiversité en lépidoptères et autres insectes des mesures importantes sont nécessaires, comme l'emploi d'insecticides moins persistants et l'interdiction de la dispersion de ces insecticides par avion.

Key words: Species variety – biodiversity – agrolandscapes – control measures – insecticides

Poltavsky, A. N.: Donskoj zonal agricultural Institution, Rostov-on-Don, Russia (poltavsky54@mail.ru).

The study of the Lepidoptera-fauna in the Rostov-on-Don region, which is located in the south of the European part of Russia, started at the end of the 19th – beginning of the 20th century (Alpheraky 1876, 1877, 1880, 1908). Researches of the present-day specific fauna and distribution of the Lepidoptera in this territory were carried out since 1972. During this time were collected: 404 species of Noctuidae, 20 species of Sphingidae, 20 species of Notodontidae, 18 species of Arctiidae, 7 species of Lithosiidae, 13 species of Lasiocampidae, 13 species of Zygaenidae, 4 species of Papilionidae, 18 species of Pieridae, 53 species of Lycaenidae, 27 species of Nymphalinae, 23 species of Satyrinae, 17 species of Hesperiidae (Poltavsky 2001, Poltavsky & Artohin 2000, Poltavsky & Nekrasov 2002).

The Rostov area is the largest agricultural region in Russia, the arable land occupies up to 80–90 % of its territory. Only insignificant part of most adaptive moths and butterflies survive in agroecosystems. These are mainly agricultural pests. The majority of Lepidoptera species concentrates on rather small local plots (refuges) kept poorly changed natural vegetative formations. These refuges were formed spontaneously in places unsuitable for agricultural use: stony and dry steppes, saline soils, sandy files, bairak woods, wetland woods, slopes of ravines, and river banks.

Entomological refuges in agrolandscape almost have no spatial isolation from associate agro-ecosystems in which significant volumes of pesticides are

constantly applied. Technologies of plant protection, which used in the Rostov-on-Don region, assume annual spraying a significant volume of insecticides: on one hectare of wheat 1.1–2.72 liters; on sugar beet 2.25 liters; on peas 3.1 liters; in orchard 10–12 liters. Insecticides, among which dominate phosphororganic and pirethroid preparations, are the constant threat for the stability of the natural ecosystems in the steppe zone of Russia and especially by avia-application.

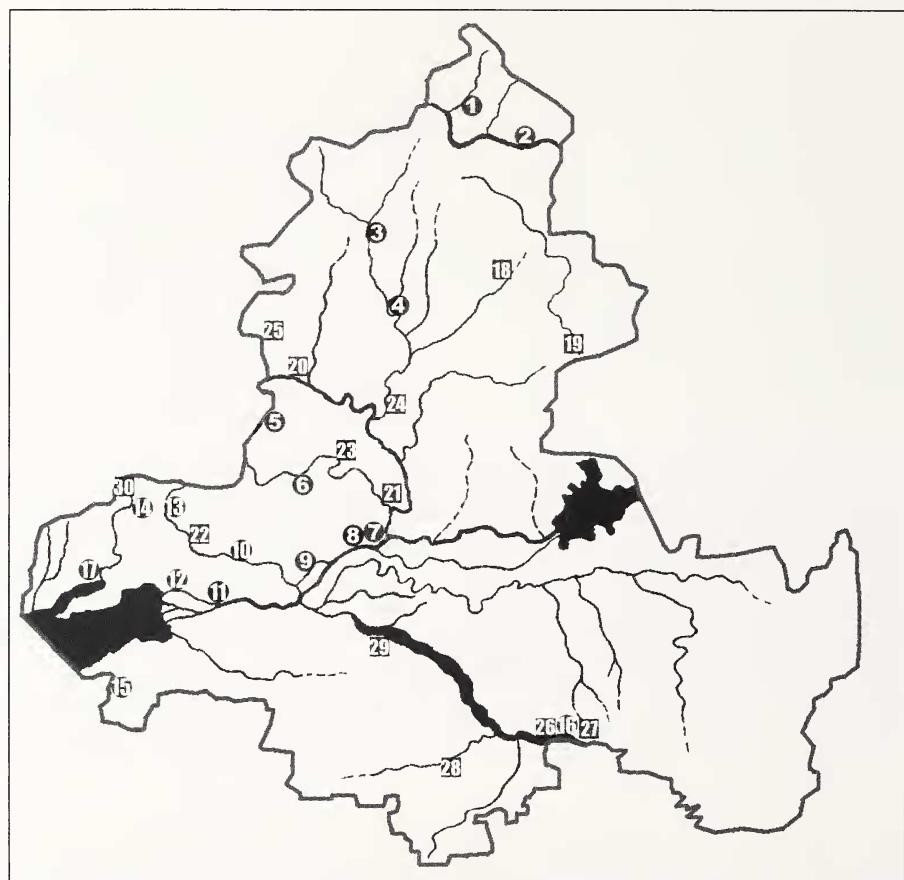
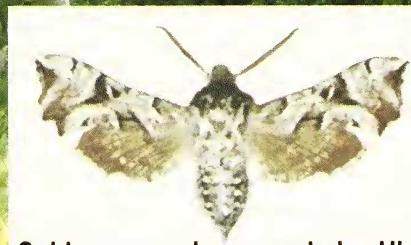


Figure 1. Entomological refuges in the Rostov-on-Don region: 1–Peskovatinsky, 2–Sholohovsky, 3–Millerovsky, 4–Efremovo-Stepanovsky, 5–Anikinsky, 6–Gornensky, 7–Kanyginsky, 8–Razdorskoy-Pukhlyakovsky, 9–Bessergenevsky, 10–Voloshino-Tuzlovsky, 11–Rostovsko-Temernitsky, 12–Nedvigovsky, 13–Lysogorsky, 14–Yasinovsky, 15–Alexandrovsky, 16–Volotchaevsky, 17–Darievsky, 18–Selivanovsky, 19–Oblivsky, 20–Kamensky, 21–Nizhnekundrjuchensky, 22–Bolshekrepinsky, 23–Zaicevsky, 24–Belokalitvensky, 25–Mitjiakinsky, 26–Ostrovnoj, 27–Krasnopartizansky, 28–«Bread ravine», 29–Krasnomanytchsky, 30–Kuibyshevsky.
 ● – well investigated, ■ – insufficiently investigated.



***Sphingoneopsis gorgoniades* Hb.**

Figure 2. Kanyginsky refuge in the Rostov-on-Don region, especially known for the occurrence of *Sphingoneopsis gorgoniades* Hübner.



***Xylomoia graminea* Graes.**

Figure 3. Nedvigovsky refuge in the Rostov-on-Don region, especially known for the occurrence of *Xylomoia graminea* Graeser.

Table 1. Lepidoptera indicator species of the entomological refuges in the Rostov-on-Don region (Southern Russia). Refuge numbers are according to figure 1.

Indicator species	Refugium numbers
Zygaenidae	
<i>Zygaena laeta</i> Hb.	2, 6
<i>Zygaena sedi</i> F.	1, 3, 6, 16
<i>Zygaena carniolica</i> Scop.	6
Sphingidae	
<i>Sphingoneopsis gorgoniades</i> Hb.	7
<i>Proserpinus proserpina</i> Pall.	2, 11, 12
<i>Hemaris croatica</i> Esp.	13, 14
Hesperiidae	
<i>Muschampia criblellum</i> Ev.	24
<i>Muschampia proto</i> Ochs.	24
<i>Pyrgus cinarae</i> Rbr.	24
Papilionidae	
<i>Parnassius mnemosyne</i> L.	3, 7
Pieridae	
<i>Zegris eupheme</i> Led.	26, 27
<i>Euchloe ausonia</i> Hb.	16
Lycaenidae	
<i>Hamearis lucina</i> L.	2
<i>Thecla betulae</i> L.	1, 6, 10, 14, 23
<i>Lycaena hippothoe</i> L.	18
<i>Lampides boeticus</i> L.	28
<i>Scolitantides orion</i> Pall.	1, 23
<i>Pseudophilotes bavius</i> Ev.	24
<i>Pseudophilotes vicrama</i> Moore	8
<i>Neolycaena rhymnus</i> Ev.	4, 7, 8, 9, 10, 12, 13, 17
<i>Plebeius (Plebejides) pylaon</i> Fisch. von Wald.	24
<i>Plebeius (Aricia) eumedon</i> Esp.	12
<i>Glaucoopsyche (Maculinea) teleius</i> Bergstr.	2
<i>Polyommatus (Neolysandra) coelestina</i> Ev.	3, 5, 12, 13
<i>Polyommatus (Cyaniris) semiargus</i> Rott.	30
<i>Polyommatus (Meleageria) daphnis</i> Den. & Schiff.	1, 2, 3, 4, 7, 13, 17
<i>Polyommatus (Polyommatus) eroides</i> Friv.	4, 21
<i>Polyommatus (Agrodiaetus) damone</i> Den. & Schiff.	13, 14
<i>Polyommatus (Agrodiaetus) damocles</i> H.-S.	13
Nymphalidae, Nymphalinae	
<i>Euphydryas maturna</i> L.	3, 4, 5, 23
<i>Euphydryas orientalis</i> H.-S.	13, 17
<i>Melitaea arduinna</i> Fr.	13, 14, 17
<i>Clossiana euphrosyne</i> L.	3
<i>Brenthis hecate</i> Den. & Schiff.	2, 3
Nymphalidae, Satyrinae	
<i>Hipparchia autonoe</i> Esp.	20
<i>Kirinia climene</i> Esp.	3, 4, 5, 7, 8, 13, 23
<i>Chazara briseis</i> L.	4, 10, 23

<i>Satyrus ferula</i> F.	5, 23
<i>Coenonympha leander</i> Esp.	2
<i>Triphysa phryne</i> Pall.	16
Noctuidae	
<i>Macrochilo cribrumalis</i> Hb.	11
<i>Naenia typica</i> L.	4
<i>Pyrrhia purpurina</i> Esp.	4
<i>Xestia sexstrigata</i> Haw.	4
<i>Acontia melanura</i> Tausch.	4, 7, 13, 18
<i>Dichonia pinkeri</i> Kobes	2, 4, 15
<i>Dichonia aprilina</i> L.	4
<i>Aedophron rhodites</i> Ev.	4
<i>Tarachidia candelfacta</i> Hb.	4
<i>Eublemma rosina</i> Hb.	18
<i>Eublemma pannonica</i> Frey.	4, 18
<i>Apaustis rupicola</i> Den. & Schiff.	5, 14
<i>Catocala lupina</i> H.-S.	2, 4, 18
<i>Catocala electa</i> Borkh.	2, 4
<i>Catocala nymphaea</i> Esp.	25
<i>Catocala conversa</i> Esp.	18
<i>Craniophora pontica</i> Stgr.	11, 12
<i>Xylomoia graminea</i> Graes.	12
<i>Chortodes brevilinea</i> Fenn.	15
<i>Chazaria incarnata</i> Frr.	16
<i>Oxytripia orbiculosa</i> Esp.	2
<i>Euclidia fornalitium</i> Tausch.	2
<i>Gortyna moesiaca</i> H.-S.	2
Arctiidae	
<i>Arctia festiva</i> Hfn.	4, 8, 10
<i>Euplagia quadripunctaria</i> Poda	7, 20
<i>Callimorpha dominula</i> L.	2

The new concept of insect biovariety preservation assumes the protection of complete entomocomplexes in all regional entomological refuges. They must be estimated from the point of view a number of insect species and ecological vulnerability. Such work was begun with the Macrolepidoptera (Rhopalocera, Heterocera) as an example (Poltavsky 2003, Poltavsky & Hatchikov 2004, Poltavsky & Liman 2002, Poltavsky & Stradomsky 2004). Altogether, 30 entomological refuges were revealed in different areas of the Rostov-on-Don region (figure 1). The refuges areas vary in intervals: 1600–30000 hectare (big refuges), 300–800 hectares (medium refuges), 20–60 hectares (small refuges). Every single refuge is substantially original in the structure of its Lepidoptera fauna. The relationships between local faunas of even a neighborhood refuge are 50–60% only.

The brief characteristic of Lepidoptera structure originality of entomological refuges could be given by analyzing the specific structure of rare indicator species (table 1). It is typical, that the number of indicator species does not include migrants which could be met with in agroecosystems and in the cities of the

region, such as: *Papilio machaon* L., *Iphiclides podalirius* L., *Argynnis pandora* Den. & Schiff.

For the protection of the preserved variety of insects it is necessary to correct the character of modern land exploitation, which is close to entomological refuges: to apply insecticides with a low persistence, to forbid aviation spraying, to sow long-term fodder grasses.

Neither protection of landscapes in reserved territories, nor permanent measures of separate rare species protection are capable to solve the problem of the protection of the Lepidoptera and other insect biodiversity. A biodiversity of insects in entomological refuges also provides a constant immigration of entomophagous into the agroecosystems, which will control the pest density in the fields. The significance of competition between phytophagous in natural ecosystems, which decrease the danger of entomological refuges transformation into centers of harmful insects multiplication is poorly studied. The role of Lepidoptera in such processes is assumed to be very important.

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